

AMATEUR SATELLITE REPORT

AMSAT's Newsletter for the Amateur Space Program.



Amateur Satellite Report is endorsed by the American Radio Relay League as the special interest Newsletter serving the Amateur Radio Satellite Community

Number 120/121

April 3, 1986

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Mir Space Station Heard On VHF Channels, Spotted Visually

Amateurs worldwide have been monitoring the progress of the new Russian space station, Mir, launched 19 February. Hundreds of observations on the easily accessible VHF frequency 143.625 MHz have been reported. Russian language voice emissions, apparently the voices of the crew, have been heard by listeners using even primitive equipment. The VHF FM signals are quite strong according to observers. It is unclear if these emissions are intended for direct reception by Russian terrestrial or marine control stations or if they are relayed to the USSR or other QTHs by relay satellite. It is not even clear if the Russians have any telemetry and voice relay satellite facilities similar to the Tracking and Data Relay Satellite System (TDRSS) of the U.S. The TDRSS has been used extensively in support of Shuttle missions to relay voice, video and telemetry when the Shuttle is outside the range of terrestrial UHF stations in NASA's tracking system.

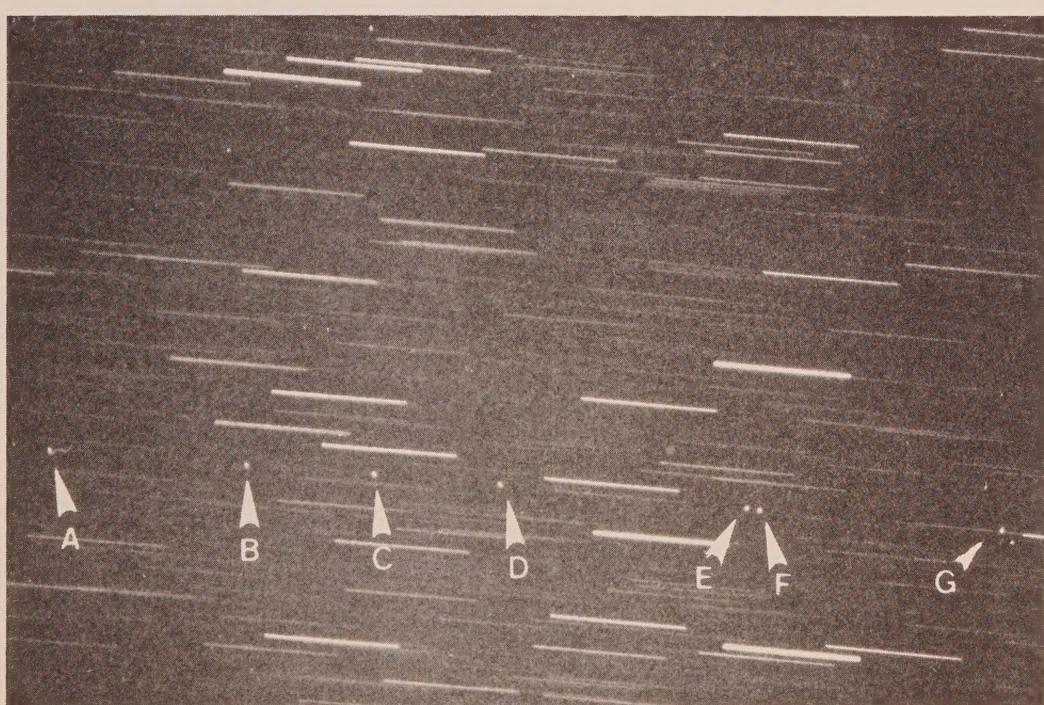
The following additional frequencies are reported to have been employed by Mir:

121.750, 142.400, 142.417, 142.600, 143.144, 143.825, 166.000, 192.040 MHz.

Numerous reports of visual observations have also been made. Mir has been easily spotted because of its large size and high reflectivity. Its magnitude is estimated to be about +1 to +2.

Complicating the radio and visual tracking activity has been the extensive maneuvering performed by Mir in recent days. The maneuvering was initially to circularize the orbit at about 330 km. Later there was additional maneuvering to facilitate docking with support shipment launches. Frequent updates to tracking data will likely be necessary to pinpoint Mir so long as the current active maneuvering phase continues.

On 19 March, says Nico Janssen, PAØDLO, Progress 25 was launched. Progress 25 is a supply and support mission. Progress 25 successfully docked with Mir on Friday, 22 March. The previously anticipated docking of Salyut-7 with



Visually observing satellites has been the hobby of Paul D. Maley for nearly two decades. This remarkable photo shows what can be done with simple equipment if you know what you're doing. Shown are seven Hughes Aircraft geo-synchronous communications satellites serving North America. (White dots) The streaks are star tracks in this 5 minute time exposure. Left to right (east to west) the comsats are:

- A: Galaxy 3 at 93.3 W
- B: SBS-3 at 94.8W
- C: Telstar 3A at 95.8W
- D: SBS-2 at 96.8W
- E: Westar 4 at 98.8W
- F: SBS-1 at 98.9W
- G: SBS-4 at 100.8W

Photo was taken from Brazos Bend, Texas near Houston at local midnight on 4 Oct. 85. Equipment included 34mm SLR camera with 200mm telephoto lens, ASA 1000 speed film and tripod. Paul estimates the objects at +10.5 magnitude. (Photo copyright Paul D. Maley by permission)

Mir has not taken place, however. Instead, Salyut-7 has apparently docked with Cosmos 1686, an unmanned support and supply ship which was launched last year. According to PAØDLO, the small Amateur Radio satellite ISKRA-4 was not aboard the Progress 25 launch.

Although detailed plans for Mir have not been announced, this much is known. The current two-man crew will recover to earth soon since their mission to check-out and commission Mir is nearly complete. Mir will then remain vacant for a short period. Then, Mir's first long-duration crew will launch to Mir and take up residency for an indeterminate period. Mir will be permanently manned thereafter for a period of several years, probably into the 1990's. The basic Mir module will be expanded incrementally by the addition of modules attached to the multiple docking ports which can interface six modules including Mir itself.

The first long-duration crew is expected to be launched in a few weeks according to knowledgeable sources. The April 12-13 window is thought to be especially fertile since it marks the 25th anniversary of the third flight of Yuri Gagarin. The Russian planners have in the past often tried to synchronize major space events with the anniversary of historically significant political or scientific events.

Sources indicate Amateur Radio activity from Mir is quite likely soon. AMSAT will sponsor its Second-Ever Chicken Little Contest to predict the decay from orbit of ISKRA-4 after its launch from Mir. The contest will be started only if ISKRA-4 carries a transponder or beacon in the Amateur bands so it is trackable by Amateurs.

MARCE Official Confirms AO-10 FM Relay Success

Ed Stluka, W4QAU, has told AMSAT that based on audio cassette recordings provided by KG6DX, it is now certain that MARCE signals emitted from the Shuttle-borne GAS-can experiment were actually relayed through AO-10, Mode B. Moreover, says Ed, the signals were sufficiently strong for KG6DX to use FM demodulation and to partially read the FM, voice synthesized telemetry of MARCE.

MARCE, the Marshall Amateur Radio Club Experiment, flew on Shuttle Columbia launched 12 January 1986. Telemetry relayed through AO-10, Mode B, had previously been reported by a few observers but they had been obliged to use SSB/CW demodulation modes since the signal was not sufficiently strong to allow FM demodulation. (FM typically requires a 10 dB signal-to-noise-ratio for adequate demodulation). Apparently KG6DX had all conditions working right. It appears AO-10 was near perigee with Columbia relatively close by. The AO-10 transponder was apparently lightly loaded at the time as well. KG6DX is located on Guam; few other AO-10 users were located in the AO-10 footprint at the time of the relay. MARCE transmitted at a mere 6 watts EIRP on 435 MHz.

The demonstration was a great surprise to AMSAT engineers who believed the relay possible but improbable. It does point out the superb sensitivity of the Mode B receiver, these officials remarked.

Area Coordinators Needed!

AMSAT continues to build its team of field representatives, the Area Coordinator corp. This is the enthusiastic team of AMSAT members who present AMSAT's Amateur Space Program at conventions, hamfests, club meetings and other gatherings. They are the ones who help newcomers get started. Over a hundred Area Coordinators are on board but we need a hundred more. Want to participate? Contact Mike Crisler, N4IFD, 8431 S.W. 137th Ave., Miami, FL 33183.

The complete telemetry report and analysis is nearing completion according to W4QAU. The list of telemetry observers will shortly be sent to AMSAT, he says. AMSAT will be sending awards and citations to individuals who copied the direct MARCE downlink as well as the telemetry relayed through AO-10 last January.

Hamvention Plans Announced

The Dayton Hamvention this year will again involve a strong AMSAT participation. The Hamvention runs from April 25 through 27 at the Hara Arena in Dayton, Ohio. AMSAT currently has forums scheduled on Friday and Sunday and is seeking additional time on Saturday, April 26. Three AMSAT booths will be in the display area and will be continuously manned. New software and various new AMSAT articles of interest will be displayed for the first time at Dayton. Mike Crisler, N4IFD, AMSAT's lead convention planner, has been working hard to insure a large AMSAT success at this year's convention. The Dayton Hamvention is one of the largest gatherings of hams in the world drawing 25,000 or more annually. A mid-year AMSAT Board of Directors meeting will be held on Friday, April 25 in the Dayton area.

New AO-10 Operating Schedule Effective 16 March

The following AO-10 operating schedule will be in effect mid-April.

Mode B	MA 040 to 109
Off	MA 110 to 129
Mode B	MA 130 to 199
Mode L	MA 200 to 216
Mode B	MA 217 to 233
Off	MA 234 to 039

As always, it's a good idea to monitor the beacon for advisories on schedule changes.

Minutes of The AMSAT Board of Directors

10 November 1985

The meeting was convened at 8:25 AM on November 10, 1985 at the Westin Hotel, Vail, Colorado with the following present:

John Browning W6SP*, John Champa K8OCL, Tom Clark W3IWI*, Phil Karn KA9Q, Jan King W3GEY*, Harold Price NK6K*, Vern Riportella WA2LQQ*, Martha Saragovitz, John Henry VE2VQ*, Harry Yoneda JA1ANG*, Gordon Hardman KE3D, Molly Hardman N3CHZ, Andy MacAllister WA5ZIB, Julian Macassey N6ARE, Howard Ziserman WA3GOV, Mike Crisler N4IFD, Eric Rosenberg WA6YBT, Harold Winard KB2M, Art Feller KB4ZJ, Steve Culp K8QKY, Wilse Morgan KL7CQ, Larry Koziel K8MU, Peter Wilson K4CAV, Cleyon Yowell AD6P. (* denotes Director.)

The first order of business for the BOD was to pass a motion making the meeting non-smoking. The following topics were then discussed:

I. Election of Officers

It was proposed by John Henry to re-elect those officers whose positions are listed in the AMSAT Bylaws. This was passed unanimously. The new officers are: President - Vern Riportella WA2LQQ; Executive VP - John Champa K8OCL; VP Engineering - Jan King W3GEY; VP Operations - Julian Macassey N6ARE; Corporate Secretary - Martha Saragovitz; Treasurer - Art Feller KB4ZJ

Positions not mentioned in the bylaws were discussed and the following persons appointed: Chairman of the Board - John Browning W6SP; VP Special Projects - Bill Brown K9LF; VP Manned Spacecraft Operations - Bill Tynan W3XO; Dir. of Administration - Martha Saragovitz. The position of VP Member Services was endorsed and will be filled at a later date. The vote was unanimous.

II. Organizational Chart with Appointees

An organizational chart with appointees was presented to the BOD by the President and was endorsed unanimously. Those positions not previously mentioned are: Asst VP Eng. - KA9Q; Phase 3C Test & Integration - K0RZ; Asst. VP Eng. PACSAT - NK6K; Asst. VP Eng R&D - open; Prop. - W4PUJ; Mode S - KE3D. Under VP of Operations are: Gateway Ops - WB8ZTV; Resource Devel. - WD4FAB; Asst. VP Field Ops - N4IFD; Asst. VP S/C Usage - WH6AMX; Asst. VP Admin. - W0CY.

III. State of AMSAT Report by President, WA2LQQ

An overview on Projects, Development, Publications, Organization, Field Ops, External Relations, Fiscal Summary, Challenge Areas and Future Prospects was given.

IV. Board of Trustees

The BOD agreed that the President should consult an advisor for the Purpose of lending assistance in setting up a board of trustees.

V. Employees

Tom Clark W3IWI, moved that Jan King W3GEY, be hired as an part-time employee of AMSAT for work on the Phase 3C Project as required. This passed with a vote of 6 in favor, 1 absent.

VI. Publications

After a lengthly discussion concerning the newsletter *Amateur Satellite Report*, the the President agreed to "normalize" relations with the printer of same, Ethan Allen Printers. "Normalization" would be in the form of strengthening and clarifying AMSAT's role as publisher, allowing it to derive revenues from and generally controlling the publication more closely than before. This is to be done by the end of December, 1985. The BOD then moved to direct WA2LQQ to resolve all legal (contractual) issues with Ethan Allen Printers with especial emphasis on use of trademark and copyright. The vote was 5 in favor, 2 opposed.

The exchanging of columns with other space publications was discussed and Doug Bornstein WA2JTC, ASJ Publisher, will investigate this possibility.

VII. Annual Meeting

The 1986 Annual Meeting will be held over Veterans Day weekend. The Dallas group will be asked first if they are still interested in hosting this symposium. Members will be notified by March 1, 1986 on the meeting location decision.

VIII. Technical Review by Jan King W3GEY

Phase 3C is scheduled for launch August 15, 1986, however, the schedule is soft. In March of 86 the spacecraft will be shipped to Germany.

The role of AMSAT as an international organization was reviewed and it was moved that AMSAT proceed with all due haste to rename the organization The Radio Amateur Satellite Corp. (AMSAT - North America) was passed. The vote was 5 in favor, 2 opposed.

On a motion by Harold Price, the BOD resolved to reaffirm the motion made on November 16, 1984 that: an international Amateur Satellite Service Coordinating Committee be formed and the mandate of the Committee shall be to: 1. Establish technical and operational standards for the amateur satellite service; 2. Plan and coordinate the orbital operations of each portion of a system which may be released by the groups which launched the system; and 3. Interface with the IARU to ensure that the best interests of all Radio Amateurs are given due consideration in this planning process. In addition, the BOD voted unanimously to participate in an organizational meeting for such a group in early 1986.

Jan expressed the need to establish study groups to define project elements for Phase 3D. A technical, financial viability and user acceptance committee will report back to the BOD in 6 months when a decision on the projects will be made.

Lastly, Jan proposed that AMSAT adopt a policy of allocating at least 50% of member dues for technical projects. This motion passed unanimously.

IX. SAREX 2

Tom Clark W3IWI moved that AMSAT endorse SAREX 2 experiment as an official AMSAT project. This was passed unanimously.

X. L5 Society

John Champa presented a memorandum of agreement between AMSAT and the L5 Society. The BOD then moved to approve the L5 agreement in principle and directed John Champa to follow up on it. The vote was unanimously in favor.

XI. 1986 AMSAT Budget

AMSAT Treasurer Art Feller KB4ZJ, reviewed the 1986 budget. After some discussion and minor amendments, the budget was approved. Art then informed all officers that any expenditures over budget would be considered a donation to AMSAT.

XII. Commendations

The following people were commended for their significant contributions to AMSAT activities:

- N4IFD - For invaluable editorial/secretarial efforts on the 1985 "Beginners' Guide to OSCAR 10"
- W5IU - For his undying support at hamfests everywhere
- W3XO, W5DID, W5AVI and the team at Johnson Space Center for their support of SAREX-1
- KE4PT and the Motorola ARC of Ft. Lauderdale for their radio work for the shuttle mission
- ZL1AOX and VE1SAT for their services maintaining operation of AO-10
- JAMSAT and JARL - For superior work with JAS-1

The meeting was adjourned at 6:20 pm.



AMSAT BULLETIN

07 April 1986

TO: All AMSAT Members
FROM: AMSAT Headquarters
SUBJECT: Amending the Bylaws

Article VII of the Bylaws reads:

"Changes in the Bylaws shall require approval of two-thirds or more of the Directors. Notice of an amendment which has received approval shall be circulated to the Members of the Corporation. The amendment shall take effect thirty days after mailing of said notice, unless written objection is received from at least ten percent of the Membership. In that case a mail vote shall be taken. Approval of the amendment shall then require a simple majority of those Members responding."

AMSAT's Board of Directors last met on 10 November, 1985 in Vail, Colorado. The Minutes of that meeting are attached to this bulletin. At that meeting the Directors voted 5 to 2 in favor of a Bylaws change. This bulletin comprises notice as above in Article VIII of the Bylaws.

In sum, the Bylaws change voted by the Directors changes Article I, "Name and Definition" of the Bylaws. The new name shall be AMSAT North America.

The assenting Directors (5) were persuaded the change was a necessary symbol recognizing the changing equation in international Amateur Radio Satellite organizational dealings. In particular, proponents noted the growth of independent centers of excellence and the urgent need to foster an international oversight body. The proponents believed this could best be facilitated by a name change.

The dissenting Directors (2) argued the name change was cosmetic; a needless symbol costing more in administrative burden than it was worth. In particular, the opponents stated the name change was a hollow gesture which would affect no organizational dealings and manifest no meaningful changes in the ways satellites get built and launched.

Recognizing the news appetite of members, many have suggested *ASR* be combined with *AMSAT Satellite Journal*. We have looked at that option but feel the synthesis would do neither well. (News grows stale too quickly; magazines are difficult to produce even on a monthly basis.)

Here's our plan!

We believe *ASR* should be sent to all AMSAT members as their official membership publication.

Moreover, we believe it should be mailed at least bi-weekly. (We are looking at ways of making it a weekly so news will always be fresh...absolutely the latest). We plan no added cost to members. The format would be similar to the enclosed sample but a small percentage of advertising might in the future be accepted to reduce costs.

What about the "how-to" articles? The interesting features and "meaty" technical articles so many enjoy? The construction articles on how to build a new dish? How to interface a computer to a rotor? New tracking software? Where would these vital subjects be covered?

Yes. These ARE very important topics. AMSAT plainly needs vehicles for these materials too. And that's part of the emerging plan too!

We hope soon to announce a new monthly publication that will be especially relevant to the Amateur Space Program. AMSAT is considering joining with a major domestic Amateur Radio publisher in a joint monthly magazine. The magazine will highlight all those "meaty" technical topics you so much enjoyed in the best issues of *ORBIT* and *Satellite Journal*. But more, the technical perspective would be much broader than ever before!

If we go ahead on this course, the new joint magazine will be available to AMSAT members as an optional, extra-cost publication.

In sum, our plan is to discontinue *Satellite Journal* as AMSAT's main publication and henceforth provide *ASR* on at least a bi-weekly basis. The new (presently unnamed) monthly technical magazine would be available to you as a very reasonably priced, extra-cost option.

(Those AMSAT members already receiving *ASR* will be offered a special discount on other AMSAT publications soon to be announced).

So there it is. The framework of an idea whose time we believe has come. Look over your sample copy of *ASR*. Think about the benefits of a regular, timely newsletter and an optional monthly magazine done up the way you've said you want it: meaty, professional, thorough and educational!

I'd enjoy hearing from you on this idea. Feel free to write. And although I probably won't be able to answer each and every letter, I promise to read each one and to take each one into account in our plans.

Thanks and very 73!

Rip

Vern Riportella, WA2LQQ
President

VR:er
encl: *ASR* 120



A Special Letter to AMSAT Members from AMSAT's President, WA2LQQ

P.O. Box 177

Warwick, N.Y. 10990

07 April, 1986

Dear Colleagues:

I'd like to convey some thoughts about our publications. Then I will need your opinion.

Since so few of us can actually pitch in and build an OSCAR, most must remain content to share vicariously the thrill via the written word. And that's one major function of AMSAT's publications: communicating the sense of being there and of doing.

But there's more, of course. Perhaps even more important than communicating the *spirit* of the program is elucidating the mysteries which might otherwise enshroud Amateur Satellites and their use.

Yes. The educational role is a major one for AMSAT publications. Yet it necessarily shares equal prominence with news reporting; the "What's Happening" character of information transfer.

We have recognized the depth and breadth of the challenge to communicate concepts, satellite-user "cookbooks" and current news to our members. And over the years we have done a reasonably good job of it.

For example, years ago the majority of AMSAT members received their regular news verbally over a series of hf nets. Although many still receive information from the nets, many more active OSCAR users now receive their news via newsletters, packet radio bulletin boards or even electronic mail.

After an in-depth look at AMSAT's publications, the needs of our members and what our all-volunteer staff does best, the framework of a plan is emerging. I thought to share with you some ideas on how I see AMSAT members best served by its publications in the future.

If one thing is paramount to active satellite users, it's access to current satellite operating conditions; what to expect and when to expect it. When will Mode B be on? What is the RS-9 launch date? And so forth.

Current, authoritative and occasionally detailed news is THE key to maximum satellite operating fun. Although "learning how" is equally important, tutorials are generally long-lived. They don't grow stale as operating news is prone to do.

So if the choice is between news and tutorials, most choose news with the "how-to" guidance provided on an "as-required" basis.

Included in this special mailing to all members is a sample copy of *Amateur Satellite Report*. This newsletter, now in its sixth year, currently serves 1,000 satellite enthusiasts world-wide. It is published by AMSAT as an optional, extra-cost bi-weekly newsletter tailored to the active, news-hungry satellite enthusiast. I have been pleased to serve as *ASR*'s founding Editor and continue to donate my energies to the dissemination of current news through it.

KEY LIFE MEMBER award!

As an AMSAT KEY LIFE MEMBER, you and your station will be featured in the upcoming AMSAT-OSCAR 25th Anniversary Yearbook. And a very special, unique, KEY LIFE MEMBER decal set will be yours. Stick them on your QSL cards to let everyone know how strongly you support AMSAT. These will be available only to you as a KEY LIFE MEMBER so they will remain unique always!

Your early recognition of excellence motivated you to become an AMSAT Life Member. Your renewed commitment signals your approval of how well we've all done together!

Thanks and very 73!

Rep.

Vern "Rip" Riportella, WA2LQQ
President

YES! I want to renew my commitment to excellence. Here's my tax deductible donation! Please enroll me in AMSAT's KEY LIFE MEMBER program as follows:

Special Placement in the 25th Anniversary Yearbook and:

- KEY LIFE MEMBER certificate and 100 decals \$50.00
- KEY LIFE MEMBER certificate, 500 decals and lapel pin \$100.00
- KEY LIFE MEMBER large wall plaque, 1000 decals, lapel pin \$500.00
- DISTINGUISHED KEY LIFE MEMBER large plaque, 1000 decals, lapel pin
and engraved desk set with your call and actual spare satellite
solar cells encased in clear acrylic \$1000.00 or more
- Check Enclosed
- Charge my credit card as indicated below

Name _____
(Please print full name clearly)

Call _____
(Print)

Address _____ (Street) _____ (City) _____

(State or Province)

(Zip Code)

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MC/VISA Card Info: MC VISA Exp Date

MC/VISA Card Info: MC VISA Exp Date

MC/VISA Card Info: MC VISA Exp. Date _____

Card #

Card #: _____



The Radio Amateur Satellite Corporation

P.O. Box 27 Washington, DC 20044

07 April 86
de WA2LQQ

Dear AMSAT Colleague:

What a special year! The Silver Anniversary year of OSCAR-1 will see at least 5 NEW OSCARS launched. What a dramatic showing of support for the ideals of OSCAR!

And see how the idea has broadened. Phase 3C is being readied for an October launch. It will carry FOUR sophisticated transponders. Japan will launch JAS-1 in August. Three new Russian birds are expected too!

WHAT'S HAPPENING?

- **FIVE NEW SATELLITES THIS YEAR!**
- **TWO NEW DIGITAL TRANSPONDERS!**
- **TRANSPONDERS RANGING FROM 15 METERS TO 13 CM!**
- **FOUR NEW PUBLICATIONS THIS YEAR!**
- **NEW SATELLITE TRACKING SOFTWARE!**
- **ON-SATELLITE NETS & BULLETINS!**
- **GATEWAY OPERATIONS!**
- **RECEIVE SENSITIVITY TESTS!**
- **HF NETS, SOFTWARE EXCHANGE, QSL BUREAU, VIDEOTAPE LIBRARY**
- **MORE!**

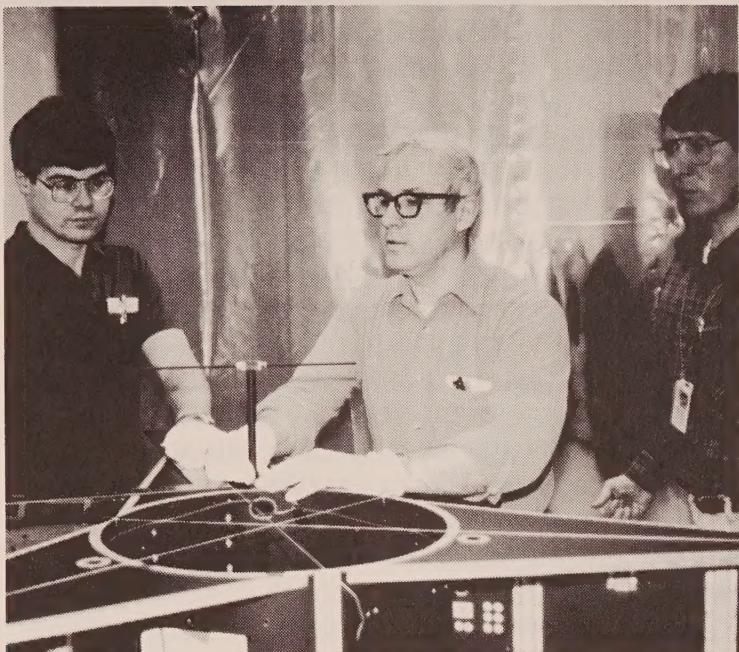
Thanks to the enthusiastic support of Life Members like yourself, AMSAT will continue to provide useful space communications systems for YOU. You see, AMSAT Life Members are our heart. We can be counted on to pull together to insure not only the current healthy state of OUR organization, but its continued well-being.

With all this activity and a bright future for new OSCARs, it's time to renew YOUR commitment to those same ideals...the ones that made you want to be a part when you first became an AMSAT Life Member.

Let's be frank.

Within every organization there are a few key supporters without whom we'd "burn out of orbit!" It's you and me...us, together who will insure we continue our excellent legacy.

To recognize YOUR CONTINUED SUPPORT, I'm announcing a special program for **LIFE MEMBERS ONLY!** When you renew your Life Member commitment in any of several ways, you receive **VERY SPECIAL** recognition!



Phase IIIC aligning and test mounting 70 cm antennas.
KA0HPP, Chic (l.), W8FAR, Hal (c.), W3GEY, Jan (r.)

Mode L Experiments To Commence

A series of experiments using AO-10 Mode L will commence the weekend of April 5-6. These experiments will lead to Mode L bulletin service using ACSSB. FM will also be used on an experimental basis.

The ACSSB signals will be compatible with normal SSB reception. Stations equipped with ACSSB receivers will realize an enhanced signal-to-noise ratio. The FM transmission experiments have two purposes. First, they will provide a basis for comparison with ACSSB in terms of effectiveness (readability) for a given power. Second, the FM experimental transmissions will be linked on a trial basis to selected repeaters for gateway transmission into test service areas. The goal is to set the foundation for bulletin delivery via satellite to gateways and thence through to users throughout the hemisphere. If these experiments are successful they could pave the way for regular service of this type using advanced Phase 3 satellites or even Phase 4, geosynchronous satellites. Phase 3C will have a single channel FM transponder, Mode S, which may further demonstrate some aspects of bulletin delivery via satellite. Mode S will have an uplink at 70 cm and a downlink at 13 cm.

The Mode L experimental station was recently completed at WA2LQQ. It consists of subsystems tailored especially for the marginal and variable sensitivity encountered with AO-10, Mode L. The variations are attributable to attitude and path loss changes which are in turn driven by sun-earth-satellite geometry.

Major components of the Mode L experimental station consist of a water-cooled 7289 amplifier by N6CA and an 5.5 meter fully steerable dish with an f/d of 0.4. The dish feed was designed by Mike Staal, K6MYJ. The ACSSB equipment was designed and built by Project OSCAR President, Jim Eagleson, WB6JNN as part of Project Companion, a joint effort of Project OSCAR, AMSAT and ARRL.

John Beanland, G3BVU, of Spectrum International is designing special receive converters to simplify the design of Mode L RO (Receive Only) equipment. Simple access

to Mode L bulletins (and later, Mode S bulletins) is the theme of Project Linkup. A small (1 meter boom) 70 cm yagi-type antenna with battery-powered ARR GaAsFET preamp taped to the boom has been interfaced to a standard 70 cm receiver. Results have been very encouraging. The Mode L beacon on 436.040 MHz has been heard up to 8 dB above the noise with this simple arrangement when Mode L was on at apogee.

According to WA2LQQ, the Mode L experimental station is designed for use primarily under the special, limited accessibility conditions of the current Mode L. Due to the malfunction of a bias regulator, Mode L downlinks are not up to expectations. It takes about 10 dB more power than had been planned to work Mode L. That is, it takes about 20 kW EIRP to generate the downlink that should have resulted from 2 kW EIRP. This relative insensitivity has, unfortunately, sharply constrained Mode L growth. The Mode L experimental station is designed to maximize utility of AO-10 Mode L and recover useful service from its tremendous potential despite its relative insensitivity.

But AMSAT officials emphasize high power will NOT be required for Phase 3C Mode JL. The recommended uplink for Phase 3C Mode JL using the L input (at 1269 MHz) is in the 2 kW EIRP range (based on current estimates of system performance). So when planning for Mode JL on Phase 3C, figure you'll need perhaps 40 watts to a 20 dBi gain antenna array. A pair of loop yagis would work well and produce at least 20 dBi if well-executed.

Another combination that will suffice for Mode JL is as little as 15 watts to a 24 dBi gain parabolic dish. A dish of this gain will normally be in the 1.6 meter (just over 5 feet) range. Some solid state 24 cm amplifiers based on the NEL 1320 transistor will easily yield 15 watts. Downeast Microwave, an AMSAT *Satellite Journal* advertiser, supplies just such amplifiers. A dish such as the UHF TV dish used by K9CIS (2.1 meters) will work well when fed with as little as 10 watts. Ten watts is the rated output of the new IC-1271A. (A dB or two need be added to account for transmission line loss).

The existence of a regular bulletin service and experiments on AO-10 Mode L is expected to spur Mode L growth and set the stage for an expected strong growth spurt this Autumn upon the launch of Phase 3C.

The Mode L test frequency will be 436.550 MHz. Tests will be conducted frequently when Mode L is visible from the experimental station. Once shake-down tests are complete, regularly scheduled bulletins and Linkup transmission will begin.

North American Mode L users are listed in the table supplied by KØRZ. See page 6.

DX-Pedition Report

Special to ASR by Hans Van de Groenendaal, ZS6AKV, President, SA AMSAT

Martin 7P8CM and Johannes 7P8DF recently visited Swaziland on an OSCAR 10 DX-pedition organized by the Lesotho Amateur Radio Society. Martin reports that their first QSO was on 23 December 1985 and that in the few

days that followed, 338 QSO's were made with stations in 40 countries.

On 30 December an unusual QSO took place between 8Q7AV and 7P8CM/3D6. During this contact Martin set up an HF QSO between 8Q7AV and 3D6QL Iris Colvin operating from Swaziland on the YASME DX-pedition. This was Iris W6QL's 100th country worked on HF from the little Southern African Kingdom. AO-10 Mode B signals from both ends were also relayed on 20 meters.

More than ten contacts were achieved with each of 8 countries. They are: Germany 109, Japan 29, Australia 26, Italy 22, France 21, U.K. 14, S.Africa 14, Austria 13.

A special QSL card featuring a Swaziland one cent stamp has been printed and will be mailed via bureaus to all stations worked.

AMSAT Satellite Operations Planning Report

by Ian Ashley, ZL1AOX, Spacecraft Commander

The following "M" BLOCK gives some of the details of changes taking place at the moment.

"M DE ZL1AOX 2102-225, 31/3/86. QST - Magnetorquing is active for the next 12 orbits, to change the attitude towards LON 205 LAT -30. Mode L time has been increased slightly and Mode B reduced to allow recharge time prior to magnetorquing. Schedule follows: Mode B MA 40 to 109, OFF MA 110 to 129, Mode B MA 130 to 199, Mode L MA 200 to 219, OFF MA 220 to 039. Omni 2 metre antenna on MA 240 to 069 for telemetry collection. Next step is attitude change towards 185,-30, starting about 7th or 8th April. Ian"

My intention is to take the attitude of OSCAR 10 to LON 140, LAT 0, with a pause of 2 to 4 days at an intermediate attitude of 185,-30. During this time the Mode L time will be centered around MA 128, with Mode B either side. As attitude approaches 140,0 transponder schedule will have Mode L at about MA 52 ± 8 counts.

Actual transponder schedules will be posted on the RTTY/CW beacon and on PSK message blocks. Precise timing of some of these changes depends on my work schedules, so expect some minor alterations to these plans.

DPØSL Log Reported; Contains Numerous AMSAT Member Calls

Last Autumn's Shuttle flight of the European Spacelab D1 included several European Amateurs. Dr. Ernst Messerschmid, DG2KM, managed to get some operating in and an automatic QSO logging machine also picked up many call-signs. The German Amateur Radio Council, DARC, recently announced the log of those Amateurs whose calls were logged by the DPØSL activity on the Shuttle Columbia. Here is that log:

4X4AS 4X4AT 4X4CW 4X4GI 4X6KA 4X6LA 4Z4ZB 8Q7AV
AA6G AJ5L CE3BCF CE3DWK CE3KB CE3OK CE3XK
CE4DLG DBØEG DB2FB DB3FB DB3ZJ DB4OF DC3KP

DC3QV DC6CF DC8QB DC9NM DC9PK DC9TM DDØSU
DD9KI DFØFMN DF3GY DF5B0 DF5EO DF5OI DF50R
DF8NS DF8QB DF8RW DF8XR DG1GR DG1PV DG2JO
DG3RAP DG4NAI DG5JA DG6NP DJ3TF DJ7ZG DJ9YW
DKØBU DKØEK DKØEM DKØSG DK2DB DK2LM DK2ZF
DK5AJ DK5MN DK5OU DL0BX DLØDZ DLØMI DLØOP
DLØRT DLØST DL1AL DL1BCF DL1CF DL2BC DL2GCO
DL2ZBY DL3LB1 DL3MDT DL4GCM DL4GCT DL4IE DL4JS
DL5BAM DL5NO DL5OT DL6BAM DL6NX DL6SCE/P
DL7RP DL8BBM DL8NCI DL8OAT DL9DQ DL9MH/P
DU1AK EA1BLA EIØRTS EI6AS EI7BJB F1YJ F6DOK F9XG
FK8AH FK8CR G3AHX G3IOR G3RUH G4FCD G4RKV/A
G4VRC G6HMS G8SBF GM6FPX GM6JVC GU4YMV
HB9CRQ HB9XB HB3PMF HLIEJ IØLYL I3LIW I5IT I8CVS
I8PWR IK8BSA IK8EYV IK8BZA IN3ZWF IWØBVG IW4ARD
IW8AS JA1JBF JA2BGX JA2YNQ JA6HOR JA7IE JA8ZWI
JG1OZH JG1QPT JG1SHH JG1SZH JH1ENZ JH1RNZ
JH4JPO JH6EGU/1 JH7CKE JH7CKF JH8DYJ JL1NHF
JL3SHC JQ11TVI JR1AQE K1PXE K6CO K6LNP/DU2 K6NLP
K6RTC K7PYK KAØNVT KAØDO KA1DUX KA2RBX KA6CR
KA7SJP KB4CRT KB6FFJ KB7RV KC7EM KD5RO KD6PY
KD6WG KD7AW KG6GF KG6KO KG6LC N1DBB N2BKT
N3FL N6CAV N6FF N6GVP N6IDN N6RW N7GDW N7ZL
N9AB NA6E ND2X/5 NF6S NK6K NNØV OE1WRK OE1WRS
OE1XTU OE5THL OE6CXG OH1AF OH1AYQ OH2BOZ
OHEAZB OH3TR OH4UC OH5LK OH7AZL OK3AU
ON1WK PAØJMV PY2BJO SM5FC SP9BGS SP9DSD SP9RKS
SP9YW SV1AB SV1GE SV1LY SV1OE SV1SL SV1UK SV1YL
SV4LD SV7RQ TR8JLD VE1AIC VE3EF VE3KLW VE3KRP
VE3LVS VE3PDD VE5LY VE5XU VE7CKA VE7CLD VE7DOX
VE7XQ VKØDJ VK2ACI VK2AHE VK2AHV VK2AIT VK2ALU
VK2AQR VK2AS VK2CPO VK2DFH VK2DFY VK2KYP
VK2XW VK2YHX VK2ZDE VK2ZZV VK3AQR VK3BLX
VK3DTO VK3ZDE VK3ZOT VK4AJI VK4ASB VK4KFQ
VK4MS VK4ZAZ VK4ZGF VK5HK VK5QR VK5ZLL VK5ZZ
VK6ADF VK6DM VK6KDX VK6OF VKYPR VK7PF WØBPP
W1HH W1NU W2JNO W3IP W3PM W4BE W4MOP
W5AQW W5CBT W5EBH W5HQW W5HUQ W5RRR
W5VY W5ZIB W6KH W6MFO W7MCU W7OHF W7QLC
W7US W9ODI WAØRCX WA1FCK WA1OMM WA3HUP
WA3WBU WA4BUS WA5NOM WA5RCL WA5ZIB
WA6YBT WA7GCS WB4KXB WB5BSH WB5GLD
WB5LB/DU6 WB7AYU WB7OHF WB8OTH WD4AHZ
WD4BCS WD4NAE WD4PQN WD5EZR WD9IIC XE1TU
YU2DI ZD8LM ZL1AOX ZL1BEZ ZL1QS ZL1TTS ZL2AHK
ZL2ARW ZL2AVI ZL2QL ZL2TAI ZL2TAX ZL3ADT ZL3AR
ZL3QL ZL3TMY ZL4FX ZM1AOX ZM1TWR ZM3QL
ZM6QRU ZR1KB ZR1KE ZR1L ZR2FK ZR5JJ ZR6AGN ZS1BI
ZS1BR ZS5AAK ZS6ALE ZS6AXT ZS6BMN ZS6BTD
ZS6BWW ZS6BZT ZS6HS ZS6SAT

(Courtesy CQ-DL 2/86)

Phase 3C Progress Report

by Colorado Area Coordinator Joe Flaska, WBØRLY

Phase 3C Status Report #6, 23 March, 1986

"And where does the black #24 wire labeled F24 go?" Such queries were often heard as Jan King, W3GEY, and Ed Means, WØVO, spent the day recently identifying myri-

ads of unterminated wires in the Phase 3C wiring harness. Although most of the wiring harness wires have long since been soldered to connectors, there are many designated spares for use where additional electronics equipment is installed. Once identified, these wires were routed to locations where needed.

The infamous Helium Bottle Bracket problem is no more. A weldment, or additional support was added to the bottom ring of this assembly. Some additional filing of material was necessary but the bottom ring now fits perfectly and the problem is solved.

There is progress on the Liquid Ignition Unit board too. While there had been a problem in the LIU board, it's reported that it now decodes properly and the board is stuffed with components. The special transformers required have been wound and are ready. Tests continue on the LIU prototype board. Once these are completed, building the flight board will commence. Construction time for the flight board is estimated at 1 week.

A satisfactory feed-thru connector for the thermal vacuum chamber has been found and will be delivered to Martin-Marietta this week. They are anxious to begin the construction of the feed-thru panel which is made of 1-inch steel plate. The 23 May Thermal-Vac test schedule is holding firm.

Bill McCaa, K0RZ, Project Manager for the Mode S transponder reports he is now 90% certain Mode S will fly on Phase 3C. Not all problems are solved, however. Mode S will be housed in two separate enclosures because of space limitations. The Oscillator, Multiplier and Mixer Chain prototype are still undergoing tests by the Colorado Springs group. The i-f unit board has been built by Gordon Hardman, KE3D, and is presently being tested. The rf Amplifier built by Chip Angle, N6CA, continues in test. Once all units are proven, the flight units will be built. The enclosures are being built by a local member of the L5 Society.

Visitors to the Golden Colorado AMSAT Phase 3C Integration Lab continue to be welcomed by local hosts. Ron Long, W8GUS, a long time satellite user, and Gerry Elder, KA0OOQ, had a look at Phase 3C recently. We expect others in the weeks ahead. Visits should be scheduled primarily during week days since weekends are likely to be heavy work periods after Easter. Also, once the AMSAT DL team arrives about 10 May, activity will accelerate and available time for visitors may be difficult to arrange. Anyone who wishes to see Phase 3C within these limitations should contact Joe Flaska, WB0RLY, at 303-238-3274, preferably several weeks in advance.

Phase 3C Status Report #7, 30 March 1986

Although there was no work session on Easter Sunday, progress continues. The successful launch of the Ariane V-17 vehicle March 28 starts the clock on the only reasonably reliable estimate of when Phase 3C may be launched. According to Jan King, W3GEY, he's been advised that the Phase 3C launch will occur no earlier than 7 months from the first launch from the ELA-2 pad, the launch which occurred March 28. Consequently, we're now facing a launch in late October, 1986.

The oversize stringers for the IHU have been promised by 2 April. A fit test is scheduled immediately upon arrival



Phase IIIC first test fit of wiring harness. WA0VSL, Doug (l.), W0VO, Ed (r.)

so delays are minimized. In addition, W4PUJ, Dick Daniels, advises that the propellant flow assembly for the kick motor will be delivered in about 2 weeks.

The Solar Energy Research Institute solar cell experiment has seen some activity this week. The PC board and its enclosure have been made and await further attention. SERI has been our host at the lab facility in Golden, and AMSAT has agreed to carry their experiment as partial repayment for their generosity in providing space.

Ed Means, W0VO, spent a day recently soldering unterminated wiring harness wires. These are not only grounds but also 12 and 14 volt connections. Another such day is planned for the coming week. W8FAR, Hal, and KA0HPP, Chic, have been busy making terminal strips at the same time

There is another day planned to bend and install more semi-rigid coax lines in the structure. This had been begun by K0KE, Eric, some weeks ago and awaited further progress on the Wiring Harness. The semi-rigid coax lines can now go in.

A meeting of world-wide command stations may be held in the Denver area at about the time Phase 3C goes into the Thermal-Vacuum test. That's still set for 23 May. Planning continues on mounting antennas on the building in which Thermal-Vac test will be performed in preparation for possible local Phase 3C operation if the transponders are turned on during the test.

W3GEY reports he has been approached by the Public Broadcasting System regarding coverage they propose to air in October in their "Discovery-Science Magazine" Program. Early thoughts are to include final integration in May, Thermal-Vac, and hopefully, launch at Kourou.

The Work Log at the AMSAT lab is being placed on disk file. For the period beginning 12 July 1985 thru 31 January, 1986, 719 man-hours were expended at the lab. This does not include vast amounts of time devoted to developmental and building work done elsewhere.

Many thanks to KC0RL, Olie, and K0HOA, Dave, of Colorado Springs, Colorado. Their efforts have made these reports available on 2m packet radio bulletin boards as well as 20meters.

North American Listing

AMSAT OSCAR 10 MODE-L ACTIVE STATION LIST

by William D. McCaa, K0RZ, March 30, 1986
Distributed by Ted Mathewson, W4FJ

CALL	NAME	QSOED	UPLINK EQUIPMENT	DOWNLINK EQUIPMENT
WA1MBA	--		5W, Single Yagi	?
WA2LQQ	Rip	*	250W, 18 ft dish	40CX KLM, GaAs
N3ERM	Jane	*	Same station as W3KH	
W3KH	Buck	*	20W, 5 ft dish	88 el J-Beam
W4FJ	Ted	*	90W, 4X23 F9FT Yagi	10T Helix
W4ODW	Gene	*	150W, 4X19 Yagi	4X19 K2RIW Yagi
WA4OFS	Harry	*	100W, 2X45 loop Yagi	8X19 K2RIW Yagi
W4WD	Russ	*	100W, 4X45 loop Yagi	10T helix, GaAs
W4WSR	Ott	*	60W, 25T helix	10T helix
WB5LUA	Al	*	10W, 24 ft dish	24 ft dish, GaAs
KD5RO	Dave	*	15W, 1X45 loop Yagi	?
W6ABN	Stan	*	50W, 1.2 mtr dish	2X12.5T helix, GaAs
KB6BQQ	Alex	*	200W, 2X24T helix	2X18C KLM, GaAs
N6GN	--		?	?
N6IZU	Bruce	*	80W, 6 ft dish	4X21 F9FT Yagi
K6MYC	Mike	*	20W, 16 ft dish	16 ft dish, GaAs
W6NDF	--		?	?
WB7ABP	Lynn	*	15W, 10 ft dish	2X10T helix, GaAs
W7GBI	Charley	*	6W, 25 ft dish	25 ft dish
KL7GNG	Tom	*	150W, 1X20 loop Yagi	2X18C KLM, GaAs
KC7GY	John	*	10W, 2X45 loop Yagi	15T Helix
KL7NO	Al	*	50W, 2X28 loop Yagi	18C KLM, GaAs
K7WUP	Shirlef	*	75W, 4X35 Yagi	2X12T Helix
W8IDU	Art	*	100W, 1X27 loop Yagi	?
K8YAH	Ron	*	130W, 4X23 F9FT Yagi	4X21 F9FT Yagi
W8YIO	Lew	*	50W, 16 ft dish	4X19 K2RIW Yagi
K9CIS	Frank	*	3.5W, 7 ft dish	4X14 KLM Yagi
W9DKP	--		?	?
WD9HAK	Emil	*	75W, 4 ft dish	4X20 F9FT Yagi
K9NO	--		?	?
W0EKZ	Bud	*	50W, 6 ft dish	2X18C KLM
KD0GT	Marty	*	10W, 4X55 F9FT	4X30 Cushcraft
W0HHE	Al	*	100W, 20ft dish	20 ft dish, GaAs
W0IT	Stan	*	100W, 55el F9FT Yagi	88el J-Beam, GaAs
K0KE	Eric	*	50W, 1X23 F9FT Yagi	8X19 K2RIW Yagi
KA0OOQ	Jerry	*	100W, 4X55 F9FT	2X88 Multi Beam, GaAs
WB0QMN	Tom	*	5W, 1X45 loop Yagi	4X21 F9FT Yagi, GaAs
WB0RLY	Joe	*	10W, 4X23 F9FT Yagi	2X416B Yagi, GaAs
K0RZ	Bill	--	120W, 4X38 loop Yagi	4X15 NBS Yagi, GaAs
K0SMI	Hank	*	4.5W, 4X23 F9FT Yagi	2X430 LBX KLM, GaAs
VE2LI	George	*	70W, 2X45 loop Yagi	40CX KLM, GaAs
VE7BBG	Cor	*	20W, 20 ft dish	20 ft dish, GaAs
VE7CLD	Gunter	*	100W, 12 ft dish	12 ft dish, GaAs
VE7VL	Val	*	20W, 12 ft dish	2X16 KLM Yagi
VE7WD	Walt	*	40W, 12 ft dish	12 ft dish

Next ZRO Tests In April

The next ZRO-Memorial Station Engineering Award receive sensitivity test will be held in late April. The exact date and time will be announced after the AO-10 operating schedule for late April is announced. The current AO-10 operating schedule will run through mid-April.

The next series of tests will, for the first time, include a Mode L receive test section. The first ZRO test was held on 5 May 85. To date, over 100 certificates have been earned by individuals who have demonstrated Mode B receive sensitivity in calibration tests scheduled 6 or 8 times per year.

Aurora Proves Bonanza for VHFers

February 8 yielded one of the most intense auroras in years. Massive solar flares beginning 5 days earlier sent geomagnetic indices to near record levels resulting in almost total shutdown of the HF bands. But for those Amateurs who

work their DX above 50 MHz, it was a day that will be long recalled.

On 6 meters, literally thousands of QSO's spanning up to half the continent were evident in all 50 states. A number of transcontinental contacts were due to a rare form of propagation known as auroral E. KH6s were worked as far east as Minnesota and Texas and HC2FG in Ecuador had a field day working stateside stations. One New England station, K1TOL, was reportedly heard in Sweden.

The low end of the 2 meter band was literally jammed with CW and SSB signals. Some were well over S-9. Aurora is normally for northwesterners. But not this one. Stations as far south as Sarasota, FL and even southern California were able to participate. What is thought to be a 2 meter North American DX record for this type of propagation was apparently set. The greatest distance covered on that band appears to be between Connecticut station KA1ZE and WB0DRL in Kansas, a path of 1348 miles.

The next two higher bands were also well represented. Many who had never made aurora contacts on 220 MHz before succeeded in doing so, resulting in new state and grid square totals and lots of thrills. WQ4V in South Carolina was especially active on this band providing a normally hard to work state. The aurora even made its presence felt on 432 MHz, but the 3 to 4 kHz of Doppler separation between actual and apparent frequencies made it somewhat difficult to establish contact. Some, listening only on their own frequency may have become discouraged at not getting any response. But those who figured out the trick were well rewarded with some noteworthy contacts. Examples include W3IP near Baltimore hooking up with Dallas area station WB5LUA, a distance of almost 1200 miles and K0US in Nebraska working stations in 11 states from Colorado to South Carolina. Despite the Doppler, there were probably more contacts completed on 432 MHz during this aurora than any previous one.

It is presently unknown if any contacts were made on the newly allocated 902 MHz band or on 1296 MHz. Several 1296 attempts were known to have been tried without success. For more details on this history making day, see The World Above 50 MHz in May QST.

(Courtesy ARRL Letter, Volume 5, No. 5, February 27, 1986)



Phase IIIC mounting IHU prior to harness test fit. W0VO, Ed (l.), W8FAR, Hal (c.), W3GEY, Jan (r.)

Short Bursts

- AMSAT Net Manager Wray Dudley, W8GQW has announced he will transmit the next in a series of AO-10 Mode B Bulletins on Saturday, April 5 at 1800 UTC. As usual, the service will appear on Special Service Channel (SSC) H2 which has a nominal downlink frequency of 145.962 MHz.
- AMSAT is pleased to announce the appointments of three new contributing editors to AMSAT's publications staff. They are Eric Rosenberg, WA6YBT, of Harrisburg, Pennsylvania; Pete Killingsworth, KD7WZ, of Spokane, Washington and Paul Roemer, KG6LC of Manchester, New Hampshire.
- A meeting of the San Francisco Area OSCAR Users' Group will be held in San Mateo on May 18. Program topics will include getting started on OSCAR, Phase 3C review, Mode L, Mode A and a question and answer session. Plans call for equipment displays, tracking program demonstrations, AO-10 video tapes and some equipment especially designed for OSCAR operation. The meeting will run from 0900 to 1600. Pre-registration is required. Send SASE for full information. Contact Ross Forbes, WB6GFJ, PO Box 1, Los Altos, CA, 94023.
- AO-10 Command station ZL1AOX reports the satellite will not be in good position for the North American (ARRL) Field Day this June. The satellite is in view only during perigee and Ian reports the chances are poor it can be turned on during the perigee passage because of eclipses during that period.

Phase 3C Progress Report

(News From The AMSAT Phase 3C Integration Laboratory reported by Joe Flaska, WB0RLY.)

The AMSAT DL team of DJ5KQ, Werner Haas and DK1YQ, Hanspeter Kuhlen spent March 1st and 2nd at the AMSAT lab in Golden, Colorado. Their trip was meant to promote information sharing among Phase 3C constructors and integrators. The AMSAT DL-built Rudak experiment was a special point of discussion.

DK1YQ also met with a representative of the Tucson Area Packet Radio (TAPR) group on Sunday, March 3rd.

Photo documentation using 16 mm motion pictures as well as still photos was completed on schedule. Both individuals returned to Germany March 3rd.

In other activities at Golden, the rf power amplifier module was found to be slightly larger than anticipated. Consequently, the mounting points on the stringers are wrong and new ones are to be fabricated.

The Arm-Safe Plug has been pre-wired and is installed.

The Main Battery Pack was wired and the battery case has been assembled and closed. The main battery is now mounted in the spacecraft but will likely be removed one more time to allow installation of the last mounting screw for the fuel tank.

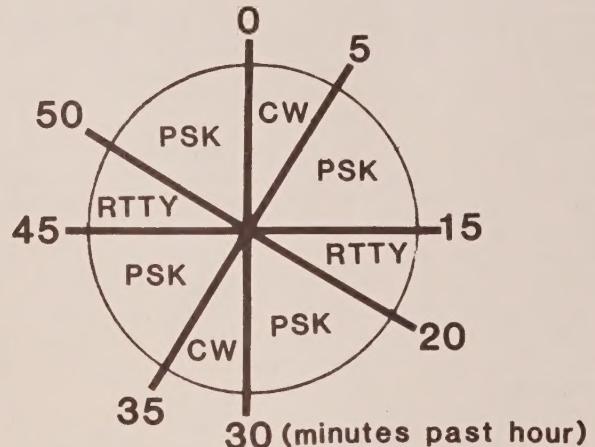
No progress was made on mounting the Helium Bottle Bracket. That awaits the manufacture of additional mounting parts. An alternative mounting plan has been decided upon.

A milestone of sorts has been achieved. The Main Fuel Tank has been mounted and all mounting screws except one have been installed. That will require temporary removal of the main battery as previously noted. The fit of the Main Tank was unusually good and the installation was relatively routine. The reaction from W3GEY was "something must be wrong...that was too easy!"

Project OSCAR Calendars Mailed

Project OSCAR officials have announced all orders for the 1986 Amateur Satellite Orbital Predictions have been mailed. All new orders are being filled as they arrive. The predictions provide equator crossing times for UoSATs 9 and 11 and RS-5 and 7. Apogee times and sub-satellite points for AMSAT OSCAR 10 are included as well. These are now available from Project OSCAR for a nominal donation. Write to Project OSCAR, P.O. Box 1136, Los Altos, CA 94023.

General Beacon Operating Schedule For AO-10



Effective August 84

WA2LQQ JUL 84

AMSAT OSCAR 10 Ground Track Templates Available

AMSAT is now making available AMSAT OSCAR 10 ground track templates for use with the ARRL OSCARLOCATOR. The template consists of a paper copy detailing in proper scale the movements of AO-10 for the period of apogee plus and minus 5.5 hours. Because of the changes in orbital geometry with time, the shape of the ground track changes. With AO-10, updates every three months or so are required. The new ground track template is usable for first quarter 1986. It is scaled for use with the ARRL OSCARLOCATOR only. A copy may be obtained free of charge if you will send a business sized SASE to: AMSAT, AO-10 Ground Track, P.O. Box 177, Warwick, NY 10990

Orbit Predictions

Keplerian Elements

OSCAR-9

Catalog number 12888
 Epoch time: 86082.47706832
 Sun Mar 23 11:26:58.702 1986 UTC
 Element set: 870
 Inclination: 97.6518 deg
 RA of node: 82.0899 deg
 Eccentricity: 0.0003330
 Arg of perigee: 39.8660 deg
 Mean anomaly: 320.2792 deg
 Mean motion: 15.28218269 rev/day
 Decay rate: 1.487e-05 rev/day²
 Epoch rev: 24787
 Semi major axis 6856.240 km
 Anom period: 94.227378 min
 Apogee: 489.009 km
 Perigee: 484.443 km
 Ref perigee: 3003.48428820
 Sun Mar 23 11:37:22.500 1986 UTC
 Beacon: 145.8250 MHz

Satellite

Catalog number 12999
 Epoch time: 86076.23856675
 Mon Mar 17 05:43:32.167 1986 UTC
 Element set: 307
 Inclination: 82.9538 deg
 RA of node: 156.5854 deg
 Eccentricity: 0.0008332
 Arg of perigee: 232.2398 deg
 Mean anomaly: 127.7900 deg
 Mean motion: 12.05050671 rev/day
 Decay rate: 3e-08 rev/day²
 Epoch rev: 18679
 Semi major axis 8033.852 km
 Anom period: 119.497050 min
 Apogee: 1675.566 km
 Perigee: 1662.178 km
 Ref perigee: 2997.20910971
 Mon Mar 17 05:01:07.79 1986 UTC

RS-5

Reference Orbits

Monday, April 07, 1986

RS-7

Mon Apr 7 01:46:36.861 1986 UTC:
 Ascending node at -82.5
 Nodal period: 119.19320 min
 Longitude increment:
 29.925168 deg w/orbit
 Element set 244, epoch:
 Thu Mar 20 04:40:52.2 1986 UTC

NOAA-9

Mon Apr 7 01:38:09.258 1986 UTC:
 Ascending node at -164.0
 Nodal period: 102.08141 min
 Longitude increment:
 25.519189 deg w/orbit
 Element set 80, epoch:
 Mon Mar 24 02:28:05.902 1986 UTC

mir

Mon Apr 7 00:19:29.34 1986 UTC:
 Ascending node at 42.6
 Nodal period: 91.32895 min
 Longitude increment:
 23.220570 deg w/orbit
 Element set 59, epoch:
 Thu Mar 27 16:04:17.39 1986 UTC

RS-5

Mon Apr 7 01:51:30.122 1986 UTC:
 Ascending node at -77.7
 Nodal period: 119.55366 min
 Longitude increment:
 30.015424 deg w/orbit
 Element set 307, epoch:
 Mon Mar 17 05:43:32.167 1986 UTC

AO-10 Apogees

The first apogee of each UTC day with SSP.

Day Date Time Latitude Longitude Arg.Per.

Satellite

Catalog number 16609
 Epoch time: 86086.66964166
 Thu Mar 27 16:04:17.39 1986 UTC
 Element set: 59
 Inclination: 51.6221 deg
 RA of node: 295.5570 deg
 Eccentricity: 0.0014678
 Arg of perigee: 4.4656 deg
 Mean anomaly: 355.4020 deg
 Mean motion: 15.73868049 rev/day
 Decay rate: 0.00085438 rev/day²
 Epoch rev: 566
 Semi major axis 6726.507 km
 Anom period: 91.494328 min
 Apogee: 358.315 km
 Perigee: 338.569 km
 Ref perigee: 3007.67045318
 Thu Mar 27 16:05:27.154 1986 UTC

mir

Day	Date	Time	Latitude	Longitude	Arg.Per.
Mon	07Apr	03:56:29	25.8s	246.4w	99.3
Tue	08Apr	03:15:34	25.8s	237.0w	99.5
Wed	09Apr	02:34:37	25.8s	227.6w	99.8
Thu	10Apr	01:53:42	25.8s	218.2w	100.0
Fri	11Apr	01:12:47	25.7s	208.8w	100.3
Sat	12Apr	00:31:51	25.7s	199.4w	100.6
Sun	13Apr	11:30:29	25.7s	5.3w	100.9

OSCAR-11

Catalog number 14781
 Epoch time: 86074.62720356
 Sat Mar 15 15:03:10.387 1986 UTC
 Element set: 125
 Inclination: 98.1591 deg
 RA of node: 142.8622 deg
 Eccentricity: 0.0014565
 Arg of perigee: 94.2029 deg
 Mean anomaly: 266.0840 deg
 Mean motion: 14.62035668 rev/day
 Decay rate: 1.07e-06 rev/day²
 Epoch rev: 10869
 Semi major axis 7061.822 km
 Anom period: 98.492809 min
 Apogee: 714.804 km
 Perigee: 694.233 km
 Ref perigee: 2995.64504702
 Sat Mar 15 15:28:52.62 1986 UTC
 Beacon: 145.8260 MHz

Amateur Satellite Report is published and mailed First Class bi-weekly by the Radio Amateur Satellite Corporation. The purpose is to enhance communications about the Amateur Radio Satellite Program. Subscription rates for the United States, Canada, and Mexico are \$22.00; Foreign is \$30.00. The rate covers 26 issues (typically one year). Send check or money order in U.S. funds (drawn on U.S. banks only please) to "Satellite Report," 221 Long Swamp Road, Wolcott, CT 06716. Information contained herein may be quoted without permission provided credit is given to Amateur Satellite Report, Wolcott, CT 06716. Amateur Satellite Report is Copyright Protected and duplication of this publication in any way including by the photocopy process or by electronic means (computer data banks, etc.) is not permitted under any circumstances. Amateur Satellite Report is endorsed by the ARRL as the special interest newsletter serving the Amateur Radio Satellite Community. The editorial opinions expressed are not necessarily those of the ARRL.